

AD-A148 124 POINT DEFECTS LINE DEFECTS AND INTERFACES IN
SEMICONDUCTORS(U) GORDON RESEARCH CONFERENCES INC
P M PETROFF 1983 N00014-83-G-0026

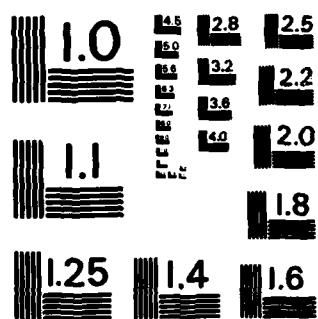
1/1

UNCLASSIFIED

F/G 28/2

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

NR-322 11-11-11
C
AD-A148 124

FINAL REPORT

POINT DEFECTS, LINE DEFECTS
AND INTERFACES IN SEMICONDUCTORS

JULY 11-15, 1983

PLYMOUTH STATE COLLEGE (S)
PLYMOUTH, NEW HAMPSHIRE

ONR Grant No. : N00014-83-G-0026

CHAIRMAN

Dr. Pierre M. Petroff
AT&T Bell Laboratories
600 Mountain Ave.
Murray Hill, NJ 07974 USA

SDT
SELECTED
NOV 23 1984
A

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

FINAL REPORT

Introduction

The 1983 Gordon Conference on Point Defects, Line Defects and Interfaces in Semiconductors was held at Plymouth State College, Plymouth, New Hampshire on July 11-15, 1983. There is a great deal of activity in this field, since the science is pertinent to both micro-electronics (in all its facets) and to photo-voltaic solar cells, and both these technologies are science-limited. It is worth noting that the Europeans have copied this meeting in the so-called "Lund" conferences, and now the Eastern bloc nations have been holding frequent similar meetings, e.g., the Matrafured (1982) and Eger (1983) conferences in Hungary, and the Szczycyrck (1985) conference in Poland; there are frequent similar meetings in Japan.

As the conference title indicates, the conference covered point defects, line defects (both precipitates and dislocations) and interfaces. The semiconductors treated included silicon and III-V compounds, although the Banquet speaker discussed optoelectronic research in Japan in its broadest aspects.

Organizational

The conference consisted of twenty-one invited talks in ten sessions, each headed by a Session Chair. [A copy of the conference program is included in this report.] In addition there were forty contributed (poster) papers divided into two groups, with special times for the participants to consider these papers.

There were 107 participants. [The list of participants is included in this report.] Of these 78 were from the US: 40 from industry, 30 from universities, and 8 from government laboratories. The 29 participants from abroad were distributed as follows: 11 - West Germany; 7 - France; 5 - Japan; 4 - United Kingdom; and one each from Canada and the Netherlands.

11

Accession For	
NTIS GRAAI	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification <i>letter</i>	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Technical

The essence of the Gordon Research Conferences is discussion, and the topics treated were selected with that in mind. There was vigorous and fruitful discussion on every topic, and on many of the poster papers.

Three point defects topics had whole sessions devoted to them: Oxygen in Silicon, Point Defects in III-V Compounds and Transition Elements in Semiconductors. Much of the first topic focused on the thermal donor problem, a problem almost thirty years old in 1983, but one that received a great impetus by its treatment at the Conference; indeed subsequent work promises to complete the understanding of this problem. The anti-site defects dominated the discussion of point defects in the III-V compounds, with the increasing recognition that the EL2 defect is in fact a family of defects with similar properties, a family based on anti-site defects. The transition elements, in particular the simple interstitial and substitutional iron series elements, were covered theoretical and experimental reviews; there remains to be studied the important problem of what happens to these mobile elements in real crystals.

The review of Hydrogen in Silicon summarized the recent reconciliation of many conflicting results, so that there is now a consistent working model for hydrogen in silicon; the paper also treated the need for confirming work on this topic, which is important both scientifically and technologically, since hydrogen is a passivating agent for many defects. The paper on Quenched in Defects in Silicon covered exciting results of the defects trapped upon the laser-quenching of silicon, which results go directly to the long-standing question of the native high-temperature defects in silicon; the problem is not solved, because some of the defects observed in the DLTS studies have not been identified, but some vacancy-related defects were observed, indicating that the vacancy, at least is a high temperature defect in silicon. That in itself is progress, because the interstitial-only model is ruled out; it is still possible that interstitials coexist with the vacancies as native high-temperature defects in silicon.

Surfaces were discussed in several papers: Silicon-Metal Interfaces (treated both by TEM and by ion-channeling techniques), Silicon-Silicide interfaces, and Schottky Barrier Formation. All these talks presented new insight into these interfaces, and high-lighted remaining challenges.

Ionization-enhanced and recombination-enhanced processes received broad treatment theoretically and experimentally. A new mechanism of recombination-enhanced migration was discussed and shown to be important in the motion of the aluminum interstitial in silicon. The role of these enhancements in dislocation processes and the degradation of semiconductors was also treated in several papers, but much remains to be understood concerning the microscopic mechanisms involved.

In summary the conference was very successful, and plans for the next conference are already underway.

GORDON RESEARCH CONFERENCES

POINT AND LINE DEFECTS IN SEMICONDUCTORS

Plymouth State College, Plymouth NH
July 11-15, 1983

REGISTRATION LIST

Alexander, Helmut University of Koeln II Phys. Institut Zuelpicher Str. 77 D 5 Koeln 41 West Germany	516	Bartram, Ralph H. University of Connecticut Dept. of Physics U-46 Storrs, CT 06268	103
Alexander, Michael GTE Laboratories, Inc. 40 Sylvan Rd. Waltham, MA 02254	200	Benton, Janet Bell Labs. 600 Mt. Ave. Dept. 11521, Rm. 1E312 Murray Hill, NJ 07974	212
Alexander, Judith (Guest of Michael Alexander)	200	Bhargava, Rameshwar Philips Labs. 345 Scarborough Rd. Briarcliff Manor, NY 10510	Non-res.
Ammerlaan, Cornelis University of Amsterdam Valdkenierstraat 65 1018 XE Amsterdam The Netherlands	325	Bourret, Alain CENG Physique du Solide CEN Grenoble 85X 38041 Grenoble France	326
Atoji, Masao "Mike" Airtron, Div. of Litton Systems 200 East Hanover Ave. Morris Plains, NJ 07950	210	Brazdil, James Standard Oil Co. Sohio Research Center 4440 Warrensville Ctr. Rd. Cleveland, OH 44128	104
Atoji, Iris (Guest of Masao Atoji)	210	Broniatowski, Allexandre CNRS-France Lab. P.M.T.M. Av. J.B. Clement Villetaneuse 93430 France	302
Bachelet, G. Max-Planck-Institut fuer Festkorpfforschung Heisenbergstrasse 1 D-7000 Stuttgart 80 West Germany	301	Bryant, Garnett McDonnell Douglas Res. Labs. P.O. Box 516 St. Louis, MO 63166	303
Baghdadi, Aslan NBS 225/A331 Dept. of Commerce Washington, D.C. 21234	101	Bunker, B.A. University of Illinois Physics Dept. 1110 W. Green Urbana, IL 61801	201
Baraff, Gene Bell Labs. Murray Hill, NJ 07974	102		

Point and Line Defects in Semiconductors - 2

Car, Roberto IBM T.J. Watson Res. Ctr. P.O. Box 218 Yorktown Heights, NY 10598	304	De Cooman, Bruno C. Cornell University 158 Bard Hall Ithaca, NY 14853	203
Castaing, Jacques Labo Physique Materiaux CNRS Bellevue Meudon-Cedex 92195 France	312	De Cooman, Sylvie (Guest of Bruno De Cooman)	203
Chantre, Alain CNET-Grenoble BP 98 Meylan-Cedex 38243 France	403	Fraundorf, Gail K. Monsanto C. Zone T2E 800 N. Lindbergh St. Louis, MO 63167	204
Chen, Men-Chee Bell Labs 600 Mountain Ave. Murray Hill, NJ 07974	303	Fraundorf, Philip B. Monsanto Co. Zone 04D 800 N. Lindbergh St. Louis MO 63167	204
Chen, Shiu-Hui Cornell University Dept. Materials Sci. & Eng. Bard Hall Ithaca, NY 14853-0121	305	Gibson, J. Murray Bell Labs. 600 Mountain Ave. Murray Hill, NJ 07974	Non-res.
Cherns, David Bristol University Dept. of Physics Tyndall Ave. Bristol BS9 3RX United Kingdom	324	Gibson, W. SUNY/Albany Dept of Physics 1400 Washington Ave. Albany, NY 12222	106
Choyke, Wolfgang Westinghouse Res. & Dev. University of Pittsburgh 1310 Beulah Rd. Pittsburgh, PA 15235	105	Goesele, Ulrich Max-Planck-Institu Heisenbergstr. 1 7000 Stuttgart 80 West Germany	309
Cohen, David University of Oregon Dept. of Physics Eugene, OR 97403	202	Goldstein, Bernard RCA Labs. P.O. Box 432 Princeton, NJ 08540	205
Cohen, Carol (Guest of David Cohen)	202	Goldstein, Sonya (Guest of Bernard Goldstein)	205
Corbett, James W. SUNY/Albany Physics Dept. Albany, NY 12222	415	Ham, Frank GE Res. & Dev. Ctr. Lehigh University Sherman Fairchild Lab 161 Bethlehem, PA 18015	326

Point and Line Defects in Semiconductors - 3

Hanoka, Jack Mobil Solar 16 Hickory Dr. Waltham, MA 02254	Non-res.	Kelly, Paul J. IBM Thomas J. Watson Res. Ctr. P.O. Box 218 Yorktown Heights, NY 10598	304
Hayashi, Izuo OPTO-Electronics Joint Res. Lab. 1333 Kamiddanaka Nakahara Kawasaki 211 Japan	402	Kennedy, Thomas A. Naval Res. Lab. Code 6871 Washington, D.C. 20375	308
Hsu, Tung Arizona State University Dept. of Physics Tempe, AZ 85287	520	Keyes, Robert W. IBM Research P.O. Box 218 Yorktown Heights, NY 10598	206
Hutson, Andrew R. Bell Labs. Rm. 1D-427 Murray Hill, NJ 07974	108	Keyes, Andrew (Guest of Robert Keyes)	207
Ikoma, Toshiaki University of Tokyo Inst. of Industrial Science 22-1 Roppongi 7-chome Minato-ku Tokyo, 106 Japan	109	Keyes, Sophie (Guest of Robert Keyes)	207
Jaccodine, Ralph Lehigh University Sherman Fairchild Lab. Bethlehem, PA 18015	110	Kimerling, Lionel C. Bell Labs., Rm. 1E-329 600 Mountain Ave. Murray Hill, NJ 07974	507
Jaworowski, A.E. SUNY Physics Dept. Albany, NY 12222	522	Kleinhenz, Richard IBM (East Fishkill) Route 52, B 300/40E Hopewell Junction, NY 12533	209
Kahn, Antoine Princeton University Dept. EECS Princeton, NJ 08544	310	Kondo, Kazuo MIT Rm. 13-4150 Dept. of Mat. Sce. & Eng. Cambridge, MA 02139	311
Kane, Evan O. Bell Tel Labs. Murray Hill, NJ 07974	407	Krebs, James J. Naval Research Lab. Code 6605 Washington, D.C. 20375	314
Keller, Wolfgang Werner Mas-Panck-Institut für Festkorperforschung Heisenbergstr. 1 7000 Stuttgart 80 West Germany	310	Kuesters, Karl-Heinz Dept. Materials Sci. & Eng. Cornell University Bard Hall Ithaca, NY 14853-0121	305
		Lang, David Bell Labs. 600 Mountain Ave. Murray Hill, NJ 07944	408

Point and Line Defects in Semiconductors - 4

Lee, Keon	313	Paget, Daniel	404
Bell Labs		Naval Research Lab.	
600 Mountain Ave.		Code 6871	
Murray Hill, NJ 07974		Washington, D.C. 20375	
Liliental, Zuzanna	214	Pantelides, Sokrates T.	501
Arizona State University		IBM - T.J. Watson Res. Ctr.	
Physics Dept.		P.O. Box 218	
Tempe, AZ 85287		Yorktown Heights, NY 10598	
Maeda, Koji	311	Patel, J.R.	526
University of Tokyo		Bell Labs.	
Inst. for Solid State Physics		Murray Hill, NJ 07974	
Roppongi, Minato-ku			
Tokyo 106			
Japan			
Magno, Richard	421	Paynter, John M., Jr.	316
Naval Research Lab.		Bell Labs	
Code 6871		6C 312	
Washington, D.C. 20375		600 Mountain Ave.	
Mason, Linda	215	Murray Hill, NJ 07974	
MIT - Rm. 13-4153			
Dept. of Materials Sci.			
Cambridge, MA 02139			
Mooney, Patricia M.	208	Pautrat, J. Louis	306
IBM-T.J. Watson Res. Ctr.		CENG	
P.O. Box 218		BP 85 X	
Yorktown Heights, NY 10598		38041 Grenoble Cedex	
Nauka, Krzysztof	314	France	
MIT - Rm 13-1150			
77 Massachusetts Ave.			
Cambridge, MA 02139			
Newman, Kathie E.	201	Pearlman, Stephen	502
University of Illinois		University of California	
Loomis Lab. of Physics		70A/3363 Lawrence Berkeley Lab.	
1110 W. Green St.		Berkeley, CA 94720	
Urbana, IL 61801			
Newton, James	315	Pennycook, Stephen	Non-res.
Lehigh University		Oak Ridge National Lab.	
Physics Dept. #16		P.O. Box X	
Bethlehem, PA 18015		Oak Ridge, TN 37830	
Oshiyama, Atsushi	Non-res.	People, Roosevelt	317
IBM - T.J. Watson Res. Ctr.		Bell Tel. Labs.	
P.O. Box 218		Rm 1D-406	
Yorktown Heights, NY 10598		600 Mountain Ave.	
		Murray Hill, NJ 07974	
		Petroff, P.M.	503
		Bell Tel. Labs.	
		600 Mountain Ave.	
		Murray Hill, NJ 07974	
		Pinson, William	525
		Ottawa University	
		Dept of Physics	
		74 Buvland St.	
		Ottawa, Ont. K2B 6K1	
		Canada	

Point and Line Defects in Semiconductors - 5

Ponce, Fernando A. Hewlett-Packard Labs. 1501 Page Mill Rd. Palo Alto, CA 95304	317	Schneider, J. IAF Eckerstr. 4 Freiburg D-7800 West Germany	321
Prussin, Simon TRW Systems R6/2541 One Space Park Redondo Beach, CA 90278	211	Shi, Tian Sheng SUNY/Albany Physics Dept. Albany, NY 12222	517
Prussin, Miriam (Guest of Simon Prussin)	211	Silversmith, Donald J. MIT Lincoln Lab. E-118K P.O. Box 73 Lexington, MA 02173	Non-res.
Queisser, Hans J. Max-Planck-Institut Heisenberg Str. 1 Stuttgart 80 West Germany	504	Spaeth, Johann-Martin University of Paderborn Warburger Str. 100 Paderborn 4790 West Germany	518
Rabier, Jacques CNRS-Lab. de Metallurgie Physique Faculte des Sciences 86022 Poitiers France	320	Spence, J.C.H. Arizona State University Dept. of Physics Tempe, AZ 85287	320
Reynolds, Lew Bell Labs. 2525 N. 12th St. Reading, PA 19604	505	Spoonhower, John P. Eastman Kodak Co. Res. Labs. Bldg 81 Rochester, NY 14650	322
Rubloff, Gary W. IBM T.J. Watson Res. Ctr. P.O. Box 218 Yorktown Heights, NY 10598	406	Snyder, Lawrence Bell Labs. Murray Hill, NJ 07974	319
Sahu, Satya SUNY/Albany Physics Dept. Albany, NY 12222	523	Stavola, Michael Bell Labs 600 Mountain Ave. Murray Hill, NJ 07974	316
Sauer, Rolf Physikalisches Inst. (4) University of Stuttgart Pfaffenwaldring 57 D-7000 Stuttgart West Germany	318	Steeds, John University of Bristol Physics Dept. Bristol BS8 1TL United Kingdom	322
Schluter, Michael Bell Labs. Murray Hill, NJ 07974	506	Tan, Teh IBM General Technology Div. Z-40E Hopewell Junction, NY 12533	107

Point and Line Defects in Semiconductors - 6

Tajima, Michio Electrotechnical Lab. 1-1-4 Umezono, Sakura-mura Ibaraki 305 Japan	323	Weber, Jörg Lehigh University Sherman Fairchild Lab. 161 Bethlehem, PA 18015	318
Temkin, Henryk Bell Labs 600 Mountain Ave Murray Hill, NJ 07974	508	Weisbuch, Claude Thomson CSF Lab. Central BP10 Corbeville 91401 Orsay France	512
Thompson, William IBM Res. Ctr. P.O. Box 218 Yorktown Heights, NY 10598	509	Williams, R.H. New University of Ulster Coleraine Northern Ireland United Kingdom	519
Vanderwalker, Diane SUNY Dept. of Material Science Stony Brook, NY 11794	217	Willoughby, Arthur F.W. Southampton University Engineering Matériaux Dept. Southampton SO9 5NH United Kingdom	514
Wada, Kazumi Atsugi Lab. NTT 1839 Ona Atsugi Kanagawa 259-11 Japan	307	Windscheif, Johannes IAF Eckerstr. 4 Freiburg 7800 West Germany	515
Wagner, Peter K. Heliotronic GMBH P.O. Box 1129 Burghausen D-8263 West Germany	510	Zunger, Alex SERI 1612 Cole Blvd. Golden, CO 80901	401
Walukiewicz, Wladyslaw MIT 13-4150 Cambridge, MA 02139	323	Bar-Yam, Yaneer MIT 12-110 Cambridge, MA 02139	301
Wang, Paul SUNY Physics Dept. Albany, NY 12222	524	Feenstra, Randy IBM - Res. P.O. Box 218 Yorktown Heights, NY 10598	405
Watkins, George Lehigh University Dept. of Physics Bethlehem, PA 18915	521		
Weber, Eicke R. University of Cologne II Phys. Inst. Zulpichenstr. 77 D-5000 Köln 41 West Germany	511		

CORPORATION RESEARCH CONFERENCE

Point Defects, Line Defects and Interfaces in Semiconductors

P. M. Petroff - Chairman
J. W. Corbett - Co-Chairman
Plymouth State College (S), Plymouth, New Hampshire

July 11th through 15th, 1983

Monday, July 11	Structure of Extended Defects and Interfaces 9 a.m. - 12:15 p.m. (J. Speirs - Discussion Leader)	Wednesday, July 13	Point Defects in Compound Semiconductors (Bulk and Interface) 9 a.m. 12:15 p.m. (U. Schieber - Discussion Leader)
- M. Green	"Structure of Interfaces and Interfacial Dislocations in Silicon-Metal Systems" (35 minutes)	- E. Weber	"EPR and PL Studies of Antisite Defects in GaAs" (35 minutes)
- W. Green	"Ion Channeling Studies of Metal-Semiconductor Interfaces" (35 minutes)	- G. Bachelet	"Theory of Antisite Defects in GaAs and GaP" (35 minutes)
- D. Quate	"Dislocation Climbing Processes in Semiconductors" (35 minutes)	- T. Kennedy	"EPR Studies in GaP" (35 minutes)
			Defects in Semiconductor Interfaces 7:30 - 9:30 p.m. (T. McCall - Discussion Leader)
			"Bonds and Structure at Silicon-Silicide Interfaces" (35 minutes)
- A. Zunger	"Theory of Transition Elements in Si and III-V Compounds" (35 minutes)	- G. Baskof	"Schottky Barrier Formation and Interfacial Reactions in Metal III-V Interfaces" (35 minutes)
- C. A. Ammerman	"New Experimental Results on Transition Elements in Si (35 minutes)	- R. H. Williams	
Tuesday, July 12	Point Defects and Compounds (Bulk and Interface) 9 a.m. - 12:15 p.m. (G. Williams - Discussion Leader)	Thursday, July 14	Electro-Lattice Interactions 9 a.m. to 12:15 p.m. (H. Quiney - Discussion Leader)
- T. S. Sze	"Hydrogen in Si" (35 minutes)	- M. Schieber	"Migration Mechanisms and Recombination Enhanced Processes in Semiconductors" (35 minutes)
- A. Chikotra	"Quenched-in Defects in Laser Anneal 'Si' (35 minutes)	- K. Meade	"Recombination Enhanced Glide of Dislocation in III-V Compounds Semiconductors" (35 minutes)
- D. V. Lang	"Studies of Doseiling Effects at Interface: Jitter Spin Dependent DLTS" (35 minutes)	- H. Alexander	"Plasticplastic Effects in Si" (35 minutes)
			After Banquet Speaker 7:30 to 8:30 p.m.
			- I. Hayashi "The Status of Integrated Optoelectronic Research in Japan"
- M. Stavola	"Oxygen Diffusion in Si" (30 minutes)		Degradation Mechanisms 9 a.m. - 11:15 p.m. (T. Iitoma - Discussion Leader)
- P. Wagner and R. Onder	"Evolution of Oxygen Related Complexes in Si" (30 minutes)	- H. Temkin	"Optically Induced Degradation in Quaternary Compounds" (35 minutes)
- A. Bannister	"Early Stages of Oxygen Precipitation in Si" (30 minutes)	- K. Meade	"Gradual Degradation and Deep Levels in III-V Compound Semiconductor Devices" (35 minutes)

PLATEAU SESSION: A poster session is also planned for participants who wish to present recent new results. To reserve space, please give the poster title and an outline of the contents in the application. A selection will be made if there are too many posters.

END

FILMED

12-84

DTIC